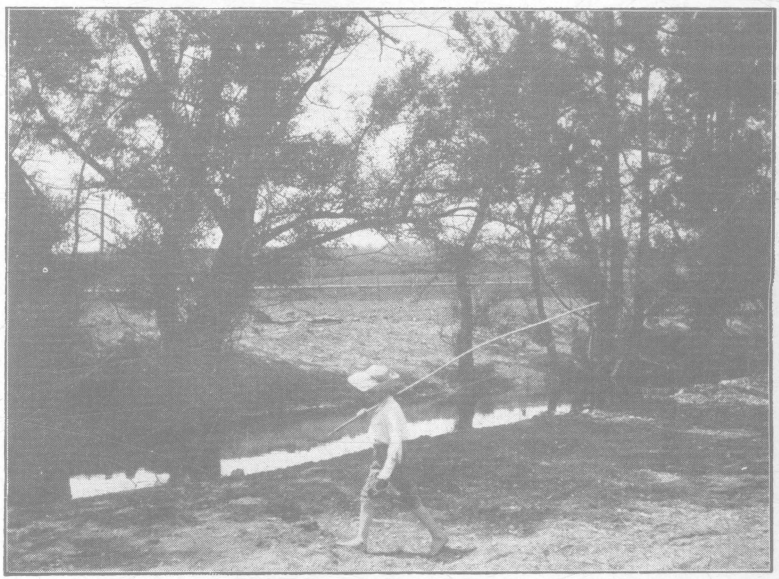
VOLUME 1 JUNE, 1906 NUMBER 9

The Agricultural College

EXTENSION BULLETIN

TILLAGE AND CULTIVATION

BY PROFESSOR A. G. MCCALL



Well!—I never seen the ocean ner I never seen the sea—
On the banks o' Deer Crick 's grand enough for me!

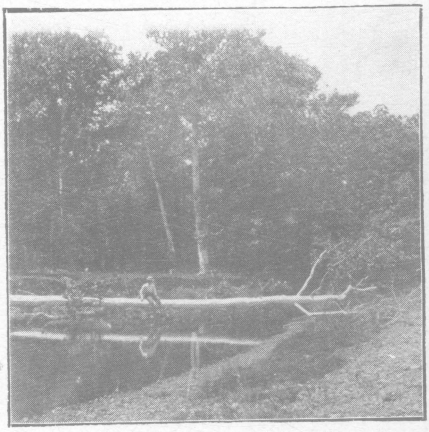
—RILEY.

PUBLISHED MONTHLY BY THE OHIO STATE UNIVERSITY

COLUMBUS

Entered as Second-Class Matter November 17, 1905, at the Post Office at Columbus Ohio, under Act of Congress July 16, 1894.

Noon-time and June-time,
down around the river!
Clean out of sight of home
and skulkin under kiver
Of sycamores, jack-oaks, and
swamp ash and ellum—



Idies all so jumbled up,
you can hardly tell 'em!—
Tired, you know, but lovin' it,
and smilin' 'jest to think 'at
Any sweeter tiredness you'd
fairly want to drink it!

—RILEY'S DOWN AROUND THE RIVER

TILLAGE AND CULTIVATION

The operation of loosening and stirring the soil is usually spoken of as tillage or cultivation. Tillage includes both the preparation before planting and the working of the soil after the crop is planted, while cultivation includes only the stirring of the soil after the crop has been planted.

For most soils it is best to practice deep tillage in the preparation of the seed-bed and shallow cultivation after the crop is planted.

Deep tillage gives the plants a large amount of room in which to send out their roots in search of plant food, allows the soil to drink in the rainfall more freely, and permits the air to enter the soil and help in the preparation of plant food. Shallow cultivation checks the rapid loss of water from the soil by forming a loose blanket over its surface, kills weeds, and helps to admit air to the surface layer of soil.

Deep tillage increases the root room for the plant.

Plants are like animals in that they must have food and drink or they soon sicken and die. Animals can move about from place to place and secure their food, but plants must get their food and water by sending their roots out into the soil. The tiny roots which spread out through the soil are busy all of the time taking up water from the soil for the use of the stalk and leaves above. This water, as it goes into the plant through the roots, carries with it the plant food which it has dissolved out of the little soil particles.

Place a lump of salt in a glass of water and stir for a few minutes. The salt disappears and you will find that the water has a salty taste. The salt has dissolved in the water and we say that the salt is in solution in the water. All of the food which comes from the soil must be in solution before it can be used by the plant. The water that goes in through the roots, passes out through the leaves into the air and leaves the plant food behind to build up the tissues of the plant.

If the soil is hard and lumpy, the little roots cannot penetrate far into it, but must feed near the surface. If we have a deep, mellow seed-bed, the roots are encouraged to go deep and gather plant food from a large amount of soil. The plant food in hard, lumpy ground is not easily dissolved. Stirring the soil and breaking up the clods brings the water into contact with more soil surface and hastens the solution of the plant food.

The depth to which the soil should be prepared depends upon the depth to which the plant roots will penetrate. Wheat, oats, and other small grains are shallow rooted and do not need so deep a seed-bed as does corn or root crops.

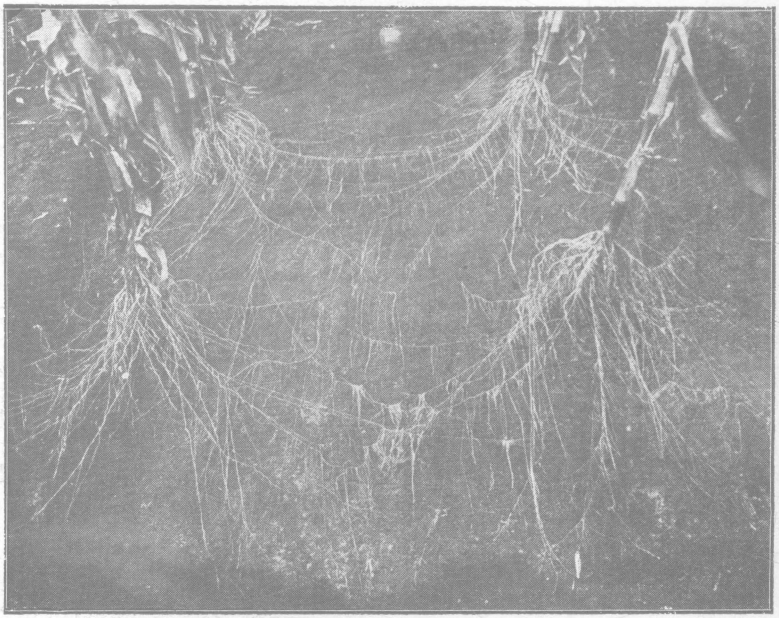
Soils that have always been plowed shallow should be deepened gradually by setting the plow to go about one inch deeper each season until a depth of eight or nine inches has been reached. If

this deepening is not done gradually, the soil will be injured and poor crops will result for several seasons.

Deep, thorough tillage enables the rainfall to easily enter the soil.

When rain falls upon the surface of a field a part of the water soaks into the soil and another part runs off the surface. If the surface of the field is dry and hard, a very large part of the rain runs off and only a small quantity enters the soil. The part which runs off of the surface is not only entirely lost to the plants, but it also washes the surface and carries away with it a large amount of plant food.

Observe what happens when a hard rain falls on a loose, mellow onion bed, and compare with what takes place on a hard path during a heavy rain. Thrifty farmers try to keep their soil mellow



From World's Work Published by Doubleday, Page & Co.

Long before the corn is "laid by" the roots fill the soil between the rows to within 3 or 4 inches of the surface. Deep cultivation at this time destroys the roots that are feeding the plant, and reduces the yield of corn.

and loose on the surface so that it will absorb and hold water enough to carry the plants through the dry, hot part of the season.

Fill two tin cans about two-thirds full of moist soil from the garden or field; leave one loose, but firmly compact the surface of the other. Pour an equal amount of water on each, and note the time that it takes it to disappear into the soil. Which takes in the water more readily, the loose or the compacted soil?

Deep tillage admits air to the soil so that plant food may be more readily prepared.

The plant food in the grains of soil more readily dissolves in the soil water if there is plenty of fresh air present. An abundance of fresh air in the soil is also necessary to encourage the work of our little friends that live in the soil and are called bacteria. These little workers are invisible, but they are busy in the soil at all times during the summer preparing plant food for our crops. If they have plenty of air they can do their work much better than if they are deprived of air, as they must be in a hard, poorly tilled soil.

A man by the name of Jethro Tull, who lived in England a great many years ago, was the first man to teach the importance of thorough tillage. He found that his system of tillage increased the available plant food in the soil, so he said that "tillage is manure." He was, of course, mistaken in thinking that tillage added anything to the soil that was not already there, but we have since learned why his system of thorough tillage gave him large crops.

Shallow cultivation forms a loose blanket over the surface of the soil and checks the loss of water by evaporation.

When a heavy rain enters the soil the greater part of the water passes down through the soil until it reaches a place where all of the openings between the soil particles are completely filled with free water. During the time between rains the plants must get their moisture from this supply deep down in the soil. The process by which this water rises in the soil is called **Capillarity.**

Fill a cup or glass with water and suspend above it a strip of blotting paper. The water immediately begins to rise in the paper and this water that apparently runs up hill is capillary water. The water in the cup represents the free water in the soil, while that in the blotting paper represents the moisture rising in the soil to supply the plants.

Make a mound of dry soil in the center of a saucer and pour water into the saucer to the depth of a half inch or more. Note the capillary rise of moisture through the dry soil. Or tie a piece of muslin over one end of a lamp chimney, fill with soil and set in a pan of water. The moisture may be seen rising through the column of dry soil by capillarity.

If allowed to do so much of this, capillary water will pass on up through the soil and be evaporated from the surface without having been of any service to the plants. To prevent this we practice shallow cultivation, which keeps a blanket over the surface of the soil.

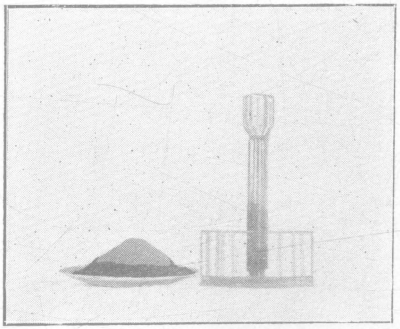
Have you ever noticed how moist the soil is under a stone or a board even when the surrounding ground is quite dry? The stone or board has kept the air away from the surface of the soil and prevented evaporation. When shallow cultivation is practiced, the thin layer of stirred soil soon becomes very dry, but by keeping the air away it serves to prevent the deeper soil from losing its moisture by evaporation. This loose blanket, or mulch, as it is called, also helps to absorb rainfall and to prevent it from running off the surface.

Frequent, shallow stirring of the soil during the growing season and especially in the time of drouth, will tend to produce a much better crop than if this work is neglected. In corn growing it is sometimes best to cultivate deep early in the season before the roots of the plants have gotten very far out into the soil, in order to allow the moisture to go deeper. But later in the season the roots of the corn spread out into the space between the rows and almost completely fill the soil to within three or four inches of the surface. Deep cultivation at this time cuts off the roots upon which the corn plants are depending for their food and water, and a poor crop is the result.

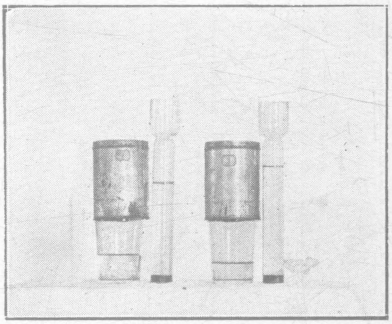
The proper implement for corn cultivation is a cultivator with a large number of small shovels rather than one with a few large ones.

Thorough cultivation destroys weeds.

The growth of weeds in a field is a serious menace to the crop, as the weeds use up the plant food that should go to the crop, and may in a dry time take up so much water from the soil that the crop will suffer from the lack of moisture. For both of these



The Capillary rise of water in dry soils. The dark portion shows the soil that has been moistened by the rise of water from below.



Tin cans, ordinary drinking glasses, and lamp chimneys are used to show that a loose soil will retain more water than one that is compacted.

reasons, as well as for the satisfaction of having a clean field at harvest time, it is desirable that all weeds should be destroyed by frequent cultivation.

We have learned that

(1) Deep tillage gives room for roots to search for food;

(2) Deep tillage allows the soil to take in rain water more freely;

(3) Deep tillage permits the air to enter the soil to assist in the preparation of plant food.

(4) Shallow cultivation checks the rapid loss of water from the soil;

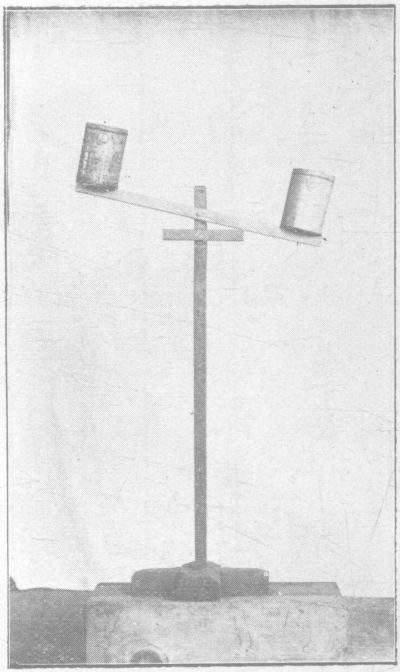
(5) Shallow cultivation kills weeds;

(6) Shallow cultivation helps to admit air to the surface layer of soil.

An Experiment to Show How Moisture is Saved by the Dry Earth Mulch Produced by Frequent Shallow Cultivation.

Nail a tin can to each end of a small stick fourteen to sixteen inches long, and balance over a nail driven through a hole at the middle of the stick.

Fill one can full of moist soil and the other to within about one inch of the top with a portion of the same soil. Pour dry dust over the surface of the soil in the second can to the depth of about one inch. Adjust the amount of soil in the two cans so that the system exactly balances. Allow the apparatus to stand over night. The amount of water that must be added to one can to restore a balance represents the water that has been saved by the protective covering of dust—the dry earth mulch. Hold the bar horizontally while adding the water.



The saving of moisture by an earth mulch may be shown by a simple apparatus made of tin cans and a few wooden strips.

The effect of mulches of cut straw, leaves, or other material may be studied in the same way.

WHY FEAR THE HARMLESS?

We have quite enough to fear without adding to our list the names of those things that are harmless.

Many children have been told that the harvest fly, or locust, that favors us with its "chee-chee-chee" through the hot days of summer, is not to be touched because its sting will kill. Why should this fly, which has no stinger, be feared more than a bumble-bee?

If you are able to do so, catch one of these so-called locusts and examine it. Can you learn how its peculiar noise is made?

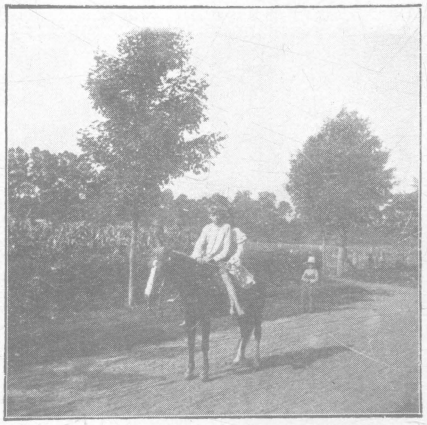
(A real locust is what is commonly called a dusty-gray grasshopper, that flies up suddenly from the field or roadside and shows you its black-striped yellow wings.)

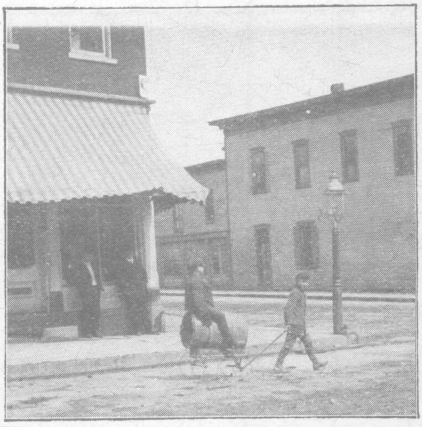
The dragon-fly, so often called snake-feeder or snake doctor, perches itself on the tip of a weed, bull-rush, or small limb near the water. On one of these it waits for a mosquito to appear. While

on a fishing excursion some afternoon this summer, watch this industrious little fellow secure his dinner of mosquitoes. If by mistake he should fly into your house or school-house, do not fear in the least to handle him, for he is as harmless as a house-fly.

The large green worms found on tomato and tobacco plants and any others resembling them, are not to be feared. That green horn, the rearing back and the striking, the wriggling and twisting as if in a spasm are no doubt intended to scare you. If you care to handle them, don't fear to do so. If you can find time to feed them until they are ready to change to a chrysalis, you may learn some valuable lessons.

Although toads are covered with warts and look repulsive, we need not fear having warts on our fingers from handling them. No child should be taught to consider seriously the old saying that killing a toad or frog will cause cows to give bloody milk. The day for such nonsense has passed.





A STRIKING CONTRAST

"In the field of God's planting there is room. The boy grows to manliness instead of growing to be like a man." Ik Marvel.

WHO ARE OUR NEIGHBORS?

Why not make a collection of the common field weeds or flowers? Carefully prepare and press them in an old book; when they are dry fasten them to the right page of a sheet of paper. Let the left page fold over on the right to furnish a cover for the plant. Make a collection of weed seeds and put them in small vials. Paste a label on the bottle.

Learn to call by name as many insects and birds as you can. Ask any one who you think knows. Don't stop until you find out what you want to know.

If you find a plant or insect you cannot name, carefully pack

and mail it to this department, and we will try to find its correct name. If there are birds you cannot name, describe them as to their size, color, and flight. Give any other points you can—nest on ground, bush, or tree; what they eat; whether they sing or whistle, etc.

SHORT COURSE IN AGRICULTURE AND DOMESTIC SCIENCE

Length of courses: Two years.

Who may enter: Any one over sixteen and under twenty-one years of age, who can show by certificates or by examination that he has a reasonable knowledge of Arithmetic, Geography, Grammar, and United States History. Any one over twenty-one may enter without examination.

What the courses offer: The first years' work in either course is preparatory to the second. In the first year Chemistry Algebra, Geometry, Physics, Botany, Geology, Shopwork, and Mechanical Drawing.

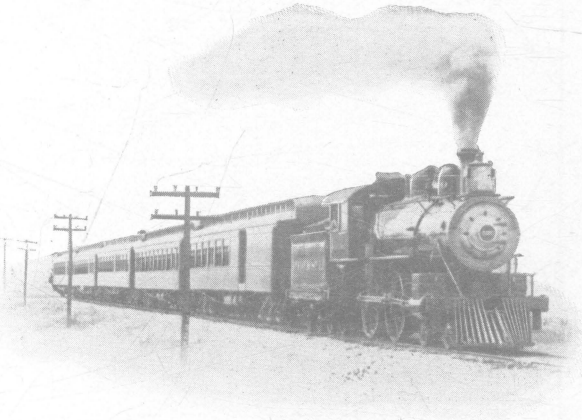
In the second year in Agriculture as thorough instruction as time will admit in Agriculture, Animal Husbandry, Dairying, Horticulture, Veterinary Medicine, Economic Entomology, and Bacteriology.

In the second year in Domestic Science as thorough instruction as time will admit in Domestic Art, Domestic Science, and related sciences.

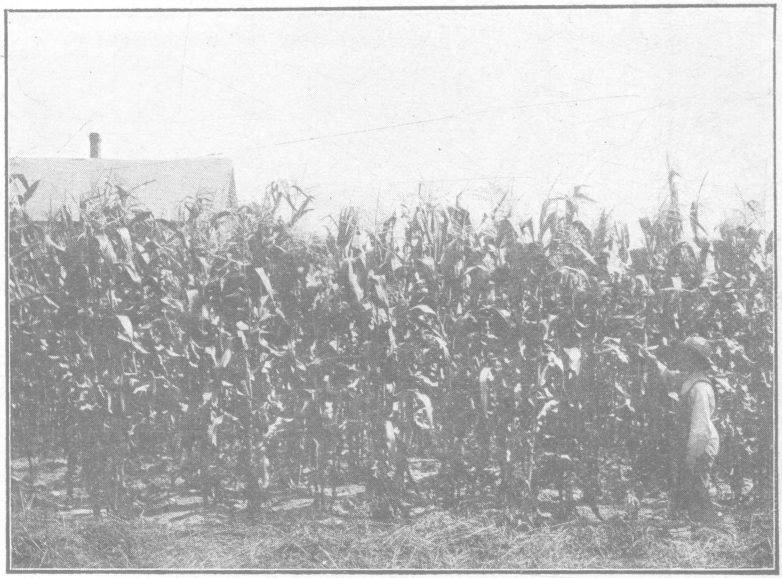
Expenses: Incidental fees, laboratory materials, books, board, room, etc, about $250. A scholarship good for two years will save a student about $25 per year. This scholarship is granted annually by each County Board of Agriculture.

A certificate is given to any one completing a Short Course.

For further information address the Dean of the College of Agriculture and Domestic Science, Ohio State University, Columbus, Ohio.



On the way to the Agricultural College of the Ohio State University.



On the way to an agricultural education at the country school.

NOTICE

The next number of this Bulletin will be issued in September. Any teacher who now receives this Bulletin and wishes to have his name placed on the mailing list for next year, should write at once, or as soon as he has determined definitely his post-office address, signifying his desire to be continued on the mailing list, and in case of a change in address, giving both the old and the new one. Address the Agricultural College Extension Bulletin, Ohio State University, Columbus, Ohio.

Members of Agricultural Clubs or pupils at present receiving this Bulletin, will have their names continued on the mailing list during next year without action on their part.

The Merry Farmer Boy.

No. 146. Words and Music by S. G. Wells.